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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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Wiebe Sjoerd Kijlstra

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SHELL OIL COMPANY

P O BOX 2463

HOUSTON, TX 772522463

EXAMINER

WU, IVES J

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PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/553,366	Applicant(s) KIJLSTRA ET AL.	
	Examiner IVES WU	Art Unit 1797	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 11 February 2009.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-11 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,3-11 is/are rejected.
- 7) ☒ Claim(s) 2 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

(1). Applicants' Amendments and Remarks filed on 2/11/2009 have been received.

Claims 1-9 are amended. New claim 11 is added.

The rejections of claims 1-10 in prior Office Action dated 11/07/2008 are revised in response to the current Amendments and presented with new claim in the following paragraphs.

Claim Rejections - 35 USC § 103

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

(2). **Claims 1, 3-4, 6-11** are rejected under 35 U.S.C. 103(a) as being unpatentable over Buisman (US 5354545A) in view of Fernandez de la Vega et al (US 5659109A) and LaFoy (US 4562300), evidenced by Nakanishi et al (US 5087195).

As to step a) of removing H₂S from the gas stream by contacting the gas stream in a H₂S removal zone with 1st aqueous alkaline washing liquid buffered at a pH between 4.5 and 10, at a temperature between 5 and 70 °C and a pressure between 1 and 100 bar to obtain a H₂S-depleted gas stream and a sulphide-comprising aqueous stream; step b) of removing mercaptans from the H₂S-depleted gas stream obtained in step a) by aqueous alkaline washing liquid buffered at a pH between 5.5 and 10 at a temperature between 5 and 70 °C and a pressure between 1 and 100 bar to obtain a mercaptan-depleted gas stream and an thiolate-comprising aqueous stream, mercaptan-depleted gas stream having a level of H₂S below 10 ppmv and a level of mercaptans below 6 ppmv in a process for the removal of H₂S and mercaptan from a gaseous hydrocarbon stream comprising these compound in **independent claim 1**, Buisman (US 5354545A) discloses process for the removal of sulphur compounds from gases (Title). A process for the removal of sulphur compounds from a gaseous effluent, comprising the steps of: a) contacting the gaseous effluent with an aqueous solution wherein sulphur compounds are dissolved (Abstract, line 1-4). The process for removing H₂S and other reduced sulphur compounds such as lower alkyl mercaptans is illustrated with reference to Fig. 1. At the start of the process, an alkaline washing liquid will be used (Col. 3, line 57-60). An important feature is that the washing liquid is buffered, preferably at a pH between 6.0 and 9.0, depending on the nature of the gas flow to be

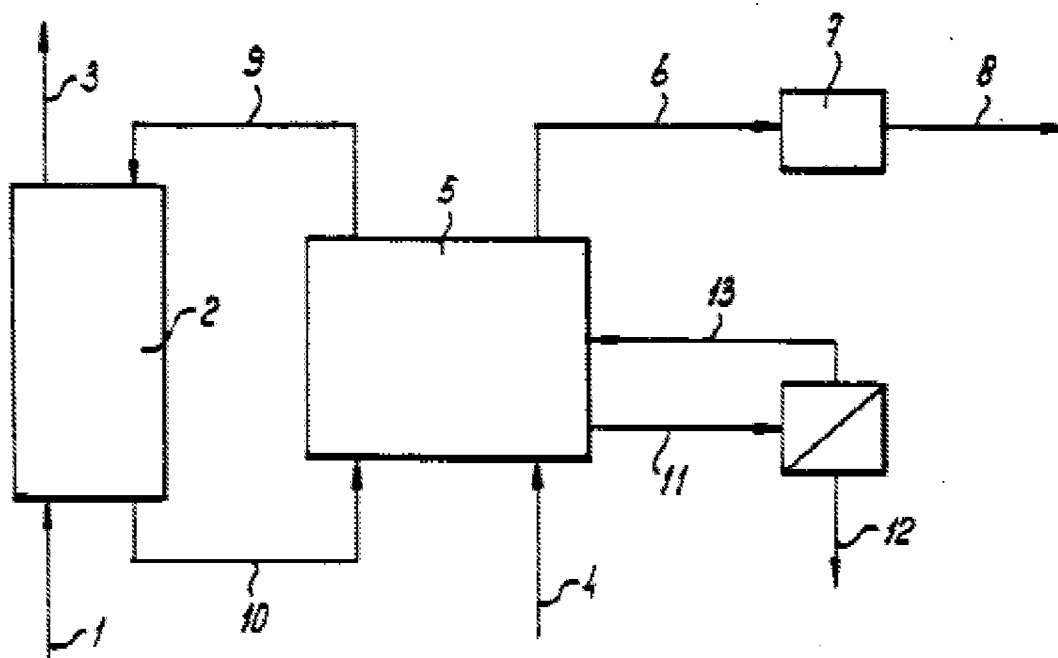
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treated and especially on the nature of sulphur compounds to be removed (Col. 2, line 42-46).

The combustible gas would include the hydrocarbon stream as evidenced by Nakanishi et al (US 5087195A) that Combustible gas contained in the combustion gas such as hydrocarbon, carbon monoxide and the like (Col. 9, line 65-67). As shown in the Example, the concentration of H₂S in the stream 3 is 150 ppm which would read on the 10 ppmv as claimed (Col. 6, Table A).

Buisman **does not teach** two separation step a) and b) for the removal of H₂S and mercaptans and operating temperature, pressure as claimed.

fig -1



B

However, Fernandez de la Vega et al (US 5659109A) **teach**, where high levels of mercaptans being encountered, removal techniques specific to mercaptans must be used in addition to the treatment process for carbon dioxide and hydrogen sulfide (Col. 1, line 21-24). LaFoy (US 4562300) **teaches** process which extracts mercaptan from a hydrocarbon streams by contacting with an alkaline solution (Col. 1, line 66 - Col. 2, line 1). This extraction process takes place at temperatures ranging from about 100° F. to about 150° F. and pressures ranging from about 60 psig to about 110 psig (Col. 2, line 50-53). Since the scrubber disclosed by Buisman

(US 5354545) is used for removal of H₂S or low alkyl mercaptans (Col. 6, line 5-7; US 5354545), the operating conditions of temperature, pressure disclosed by LaFoy (US 4562300) for the removal of mercaptans would be applicable for the scrubber of Buisman (US 5354545) for the removal of H₂S as well as the pH condition disclosed by Buisman (US 5354545) for the removal of H₂S would be applicable for the process disclosed by LaFoy (US 4562300) for the removal of mercaptans.

The advantage of separate step in addition to the H₂S removal step is to remove mercaptan when high level of mercaptans is contained in the stream. The mixed pentanes now **essentially free of organic mercaptans** and disulfides exit column 4 via conduit 28 (Col. 3, line 62-64; US 4562300)

Therefore, it would have been obvious at time of the invention to add additional step after step of removal of H₂S as disclosed by Fernandez de la Vega et al with the operating conditions employed in the process of Lafoy for the 2nd step in the process of Buisman in order to attain the advantages cited in the preceding paragraph.

As to step c) of contacting the combined aqueous streams comprising sulphide and thiolates obtained in step a) and step b) with sulphide-oxidizing bacterial in the presence of oxygen in an oxidation reactor to obtain a sulphide slurry and a regenerated aqueous alkaline washing liquid in a process in **independent claim 1**, Buisman (US 5354545A) discloses step c) of subjecting the aqueous solution containing sulphide to sulphide-oxidizing bacteria in the presence of oxygen in a reactor wherein sulphide is oxidized to elemental sulphur (Abstract, line 7-11).

As to step d) of separating at least part of the sulphur slurry obtained in step c) from the regenerated aqueous alkaline washing liquid in a process in **independent claim 1**, Buisman (US 5354545A) discloses in the Figure above, line 11, the production of sulphur will result in a sulphur slurry (11) which is partially drawn off (Col. 6, line 18-20).

As to step e) of recycling the regenerated aqueous alkaline washing liquid from the oxidation reactor to the H₂S- removal zone in step A) and to the mercaptan-removal zone in step b) in a process in **independent claim 1**, as shown in the Figure 1 above line 9 shows the recycling of regenerated washing liquid to the scrubber and line 6 in the Figure of LaFoy (US

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4562300), it would be obvious to the 2nd scrubber as the teaching of Fernandez de la Vega et al, Lafoy are combined.

As to washing liquid in step a) being buffered at a pH between 5.5 and 9 in **claim 3**, washing liquid in step b) being buffered at a pH between 7.5 and 9 in **claim 4**, Buisman (US 5354545A) discloses an important feature being that the washing liquid is buffered, preferably at a pH between 6.0 and 9.0 (Col. 2, line 42-44). Addition of buffering compounds can be done after the washing liquid has left the gas scrubber (Col. 2, line 60-62). It would apply to 2nd scrubber for mercaptan as the teaching of Fernandez de la Vega et al, LaFoy is combined.

As to H₂S concentration entering the H₂S-removal zone in step a) to be between 150 ppmv and 50 vol% in **claim 6**, Buisman (US 5354545A) discloses concentration H₂S to be 0.8 to 1.0% in Table A, which reads on the limitations as claimed.

As to H₂S concentration of H₂S-depleted gas stream to be between 0.02 and 3.5 ppmv, based on total gas stream in **claim 7**, concentration of mercaptan compounds in mercaptan-depleted gas stream being less than 4 ppmv based on total mercaptan-depleted gas stream in **claim 8**, Buisman (US 5354545A) discloses Example, the concentration of H₂S in the stream 3 is 150 ppm which would read on the range as claimed (Col. 6, Table A). LaFoy (US 4562300) discloses the mixed pentanes now **essentially free of organic mercaptans** and disulfides exiting column 4 via conduit 28 (Col. 3, line 62-64).

As to gas-treating unit for removal of H₂S and mercaptans from a gaseous hydrocarbon stream comprising these compounds, gas treating unit comprising at least two gas scrubbers for contacting the gaseous hydrocarbon stream with an aqueous alkaline washing liquid, gas scrubber having inlets and outlets, at least one oxidation reactor with inlets and outlets and a solid/liquid separator with an inlet and outlets, the 1st gas scrubber having a discharge line for gas debouching into the inlet of the 2nd gas scrubber, the 1st and 2nd gas scrubbers both having a discharge line for liquid debouching into the oxidation reactor, the oxidation reactor having an outlet debouching into the inlet of the solid/liquid separator, an outlet for liquid debouching into the inlets of the inlets of the 1st gas scrubber and 2nd gas scrubber in **independent claim 9**, the disclosure of Buisman, Fernandez de la Vega et al, LaFoy is incorporated herein by reference, the most subject matters as currently claimed, have been recited in applicants' claim 1, discussed therein, with further illustration in the Figure above.

As to 1st and 2nd gas scrubber being placed on top of each other in one vessel in **claim 10**, it would be obvious to have two scrubbers being placed on top of each other in one vessel as the teaching of Fernandez de la Vega et al is combined because re-arrangement of parts renders obvious. *In re Kuhle*, 526 F.2d 553, 188 USPQ 7 (CCPA 1975).

As to concentration of total sulphur compounds in the mercaptan-depleted gas stream to be between 0.05 and 3.5 ppmv; and the concentration of mercaptan-depleted gas stream to be less than 2 ppm, based on the total mercaptan-depleted gas stream in **claim 11**, LaFoy (US 4562300) discloses the mixed pentanes now **essentially free of organic mercaptans** and disulfides exiting column 4 via conduit 28 (Col. 3, line 62-64). Buisman (US 5354545A) discloses Example, the concentration of H₂S in the stream 3 is 150 ppm (Col. 6, Table A). It would read on the total sulphur compounds in mercaptan-depleted gas stream and mercaptan concentration being less than 2 ppmv in mercaptan-depleted gas stream as claimed.

(3). **Claim 5** is rejected under 35 U.S.C. 103(a) as being unpatentable over Buisman (US 5354545A) in view of Fernandez de la Vega et al (US 5659109A) and LaFoy (US 4562300), further in view of Momont et al (US 5298174A).

As to the contents of oxidation reactor in step c) being buffered at a pH between 8 and 10 in **claim 5**, Buisman (US 5354545A) discloses addition of buffering compounds to be done after the washing liquid having left gas scrubber (Col. 2, line 60-61). Buisman **does not teach** the pH in the oxidation reactor between 8 and 10 as claimed.

However, Momont et al (US 5298174A) **teach** low temperature caustic sulfide wet oxidation process (Title). The pH range for the treated liquor should be between 8 and 14 (Col. 3, line 56-57).

The advantage of pH value between 8 and 14 is to prevent excessive corrosion to the ferrous-base alloy system (Abstract, line 9-10).

Therefore, it would have been obvious at time of the invention to have pH value between 8 and 14 as disclosed by Momont et al for the oxidation reactor of Buisman in order to achieve the advantage cited in preceding paragraph.

Allowable Subject Matter

(4). **Claim 2** is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Response to Arguments

(5). Applicant's arguments filed 02/11/2009 have been fully considered but they are not persuasive.

As to the issues of hydrocarbon gas and temperature, pressure range not disclosed by prior art Buisman (US 5354545A) (current Remarks, page 6), however, the combined teaching with prior art LaFoy (US 4562300) would read on the current amendments as set forth in the rationale of rejection for amended instant claim 1 herein above.

As to Example of Buisman (US 5354545A) discloses purified gas leaving scrubber 2 thru line 3 having an H₂S concentration of 150 ppm. This is an order of magnitude higher than the less than 10 ppmv H₂S level achieved by Applicant's process (page 6, current Remarks). Because the "ppm" unit is parts per million based on weight and "ppmv" is parts by million based on volume, the density of purified gas effluent from scrubber would be in magnitude of 0.01 g/cm³ or less, therefore, it would reads on the claimed range of less than 10 ppmv cited in the amended instant claim 1. Examiner respectfully suggests that Applicant to provide evidence or reasonable correlation to prove 150 ppm of H₂S is not within the range of 10 ppmv or less for H₂S in the gas stream.

As to prior art Fernandez de la Vega et al (US 5659109A) do not teach or suggest removing mercaptans from natural gas stream by scrubbing gas stream with a washing liquid comprising a physical solvent or chemical solvent such as carbonate or bicarbonate containing aqueous washing liquid employed by Buisman et al. To the contrary, de la Vega teaches such processes are "expensive and complicated" and therefore mercaptan removal from natural gas should be accomplished by distillation (page 7, current Remarks). However, the background teaching of Fernandez de la Vega et al (US 5659109A) is referenced, which suggest additional step to remove mercaptan after the removal of H₂S (Col. 1, line 19-24) as evidence for combining with the scrubbing process of LaFoy (US 4562300).

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Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to IVES WU whose telephone number is (571)272-4245. The examiner can normally be reached on 8:00 - 5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Duane Smith can be reached on 571-272-1166. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Examiner: Ives Wu

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Date: April 15, 2009

/DUANE SMITH/

Supervisory Patent Examiner, Art Unit 1797